SciPack Example

The main content areas we are exploring in the physical sciences are motion, force, and energy. Energy is arguably the most important of these concepts and is fundamental to not only the physical sciences, but to all of the natural sciences. The NSTA SciPacks are excellent resources that allow for self-paced study of these concepts by the PRISM participants. The SciPacks we are using are the Force and Motion, Energy, The Earth, Moon, and Sun, The Solar System, Ocean's Effect on Weather and Climate, The Nature of Light, and Electricity and Magnetism. The SciPacks are primarily conceptual in their presentations although some simple math is included. The teachers can gauge their understanding of the subject by taking instant-feedback quizzes that are part of the SciPacks. The quiz below is taken from the Force and Motion SciPack and is a great example that tests the not-so-simple but very important concept of acceleration. The quiz also addresses the misconception that acceleration is just speeding up or slowing down.

Two cars are rounding curves. Both cars are traveling at a constant speed of 40 kilometers per hour. Car A is rounding a very sharp curve and car B is rounding a gradual curve. Which of the following are true regarding the motion of the cars?

- Car A is accelerating more than car B because it is changing direction at a faster rate.
- Car A and car B have the same acceleration because they have the same velocity.
- Cars A and B both have zero acceleration because their speeds are not changing.
- Car A and car B have the same acceleration because they have the same speed.

In addition to studying the SciPacks, the teachers participate in online discussions of questions that are posted to the groups concerning a particular SciPack. The purpose of these questions is generally to apply their content knowledge to a topic covered in a SciPack, and hopefully do so in a way that could involve their students. One example of this is the following question on motion, and is related to the quiz question above.

"Is it possible for the speed of an object to stay constant while the object is accelerating?" How would you explain this to your class?

Here is an excellent answer from a teacher that links inquiry and content and involves her students.

Yes, it is possible for an object to sustain a constant speed while accelerating. Speed is the rate of motion while acceleration is the change in speed and/or a change in direction. Therefore, an object can travel at constant 60 mph while traveling in a circle (change in direction) creating constant speed with acceleration. I would explain it to my class by creating a Homemade Accelerometer, an inverted soda bottle filled with water and a cork, to show whether or not an object is changing in speed or direction. I have the liberty of driving my students to the library every couple of weeks and this is a great topic and tool to discuss en route to the library. The students would be able to determine if we were accelerating or not by examining the cork located in the bottle.

Fascinating topics for discussion can also be found by asking for explanations of things we take for granted. An example of this is the recent discussion question:

"How would you convince grade school kids that the sun is at the center of the solar system?"

Here is one of many superb answers.

Using students' bodies works well when showing the pattern of Earth's seasons, as well as why you only see certain constellations certain parts of the year. I have done this in class using a standing lamp in the center of the room for the Sun. Then one student sits on a rolling chair. He/She is the Earth. Then other students stand in "patterns" they are the constellations. As I roll the Earth around the room in its "orbit" we discuss which season it would be and which constellations can be seen and why.

I felt that the pedagogical implications brought out several interesting points. It not only outlined the four basic concepts that 3rd-5th should learn about the solar system, but mentioned several different activities that could be used with this age group. I liked the one that students model the motion of Earth, Moon and other planets by using their bodies. Now, I will have to spend more time learning about Galileo and Jupiter's moons. If it ever quits snowing, I may have to get my binoculars out and observe the night sky.

This was followed up by the following response from another PRISM participant.

Nice.....I love models and kids explaining what they learned in their very own group project. That brings out more questions for all to discuss and share just like we do at our workshops.

I also know that my 5th graders understand the concept of the moon's phases. With this concept I would also go into detail of why we have phases of the moon (the moon in respect to the sun). After having the kids demonstrate this using a flashlight and different spheres we would discuss and demonstrate how these phases would not work if the earth were in the center of the solar system. By having the kids physically move around a bright light/flashlight this would demonstrate how we would not have the phases due to the positions being constant.

I would then pull out my model of the solar system and turn the light on and move the planets around to demonstrate what we have seen. After this we would discuss retrograde movement and why it appears that some planets move backwards due to their rotational pattern. I would then possibly have the kids create their own moving models of the solar system using styrofoam balls, wire, string, etc. I would allow them to use the internet to research their creations and how they can create an accurate representation.

These are typical responses of the PRISM participants to the discussion questions. They show that teachers are becoming more confident in their content knowledge, more confident in their answers, and more confident in finding the answer when they don't know it. These are very positive results.